Billroth I Resection for Peptic Ulcer

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• **The Billroth I gastric resection, with and without vagotomy, was used in 20 selected cases of peptic ulcer.**

Vagotomy and pyloroplasty is considered the operation of first choice for duodenal ulcer. The cases for Billroth I resections were selected from cases not suitable for pyloroplasty.

Operations for peptic ulcer which preserve the gastrointestinal continuity are considered to be physiologically superior. Vagotomy and pyloroplasty, and Billroth I gastric resection both qualify in this regard. The postoperative digestive symptoms after Billroth I gastric resection in the present series were minimal, which tends to confirm this theoretical superiority.

THE BILLROTH I gastric resection for peptic ulcer has been used with increasing frequency in recent years in spite of the prejudice of many against the procedure. Bohmansson[2, 3] of Sweden has renewed the interest in the operation. In America, Clagett, Waugh and Higgenson[4, 12] advocated its use for gastric ulcer, and Harkins and associates[15] extended its application to include duodenal ulcers as well. Other surgeons, among them Kocher,[13] von Haberer,[9] Finney,[8] Schoemaker[23] and Polya,[19] through the years since Billroth first described the procedure in 1881, have favored its use, although standing alone among their contemporary surgeons.

This report will relate the experience with Billroth I gastric resection at the Veterans Administration Hospital, Long Beach. Since April 1954, 20 patients have had a Billroth I gastric resection, either alone or in combination with vagotomy. The rationale of the procedure will be discussed, and data on the indication, technique, morbidity, mortality, and early results in these cases will be given.

Surgical operation for peptic ulcer aims to alter the stomach physiologically in such a way as to afford protection against recurrence of disease and still maintain good digestive function. Overruling these considerations is the fact that the alteration must be done with safety to the patient. Balfour[1] brought out these points very well in an editorial in 1934.

Acid-pepsin secretion is in general controlled by three factors. (1) The cephalic phase is mediated through the vagus nerve. The importance of acid-pepsin secretion due to vagal hyperfunction in human beings, particularly the importance of the nocturnal hypersecretion, has been clearly shown by Dragstedt.[5, 6] (2) The gastric phase is mediated through gastrin, a hormone which is produced in the antrum, mainly in response to mechanical distention. Animal experiments on the dog with isolated gastric pouches and transplanted antrums, in the laboratories of both Harkins[22] and Dragstedt,[7] pointed to the great importance of antral function in producing ulcer. Whether these results can be related to human beings is uncertain. Dragstedt, however, expressed belief that antral function may be the determining factor in gastric ulcer. (3) The intestinal phase is generally considered to have little part in the production of peptic ulcer. Recently Porter, French and Movius,[20] described a late cephalic phase mediated through the pituitary-adrenal axis. Its role in the production of ulcer is uncertain; it may help to explain the occurrence of ulcer in association with corticosteroid therapy.

Good digestion depends primarily on the function of the stomach. The stomach acts as a reservoir for ingested food. It corrects the temperature and tonicity of this food by its rich vascular supply and abundant secretions. By means of its heavy musculature it triturates the food, and mixes it with the gastric enzymes. With antral contraction, the pylorus relaxes, and a small amount of chyme passes into the duodenum. Thus the small bowel receives a prepared material, one which is of the correct temperature, is isotonic, is triturated into small particles, is partially digested, and is delivered in small amounts.[14]

Digestion depends further on the supply and adequate mixing of the pancreatic, hepatic and intestinal secretions with the chyme; of these the pancreatic secretions are the most important. Secretin, a hormone which is produced for the most part in the duodenum as a result of the presence of chyme, is the most important factor in stimulating pancreatic secretions. The secretion of bile and succus entericus comes about mainly as a result of stimulation of the duodenum by chyme.

All gastric operations for peptic ulcer alter in some fashion and to variable degrees the acid-pepsin

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TABLE 1.—*Nature of disease in 20 cases in which Billroth I operation was done*

	Cases
Actively bleeding duodenal ulcer	6
Gastric ulcer	6
Concomitant gastric and duodenal ulcer	4
Actively bleeding gastric ulcer	1
Obstructed duodenal ulcer	1
Jejunal ulcer, following vagotomy and gastroenterostomy	1
Duodenal ulcer, following vagotomy and pyloroplasty	1
	20

production of the stomach and the digestive functions of the stomach and intestines. The ordinary Billroth II gastric resection removes the antrum and a considerable part of the acid-pepsin bearing portion of the stomach. It depends entirely on the compensatory ability of the intestine to make up for disturbances in digestion. The Billroth I gastric resection aims to disturb the digestive function as little as possible. In this connection Harkins and co-workers[10] recently suggested a combined physiological operation for peptic ulcer, one that would provide maximal alteration of the factors controlling acid-pepsin production and minimal alteration of the factors controlling digestion. The proposed operation was vagotomy, antrectomy and gastroduodenostomy.

At the Veterans Administration Hospital at Long Beach, vagotomy and pyloroplasty is the operation of first choice for duodenal ulcer. It meets the criteria of Balfour very well. It is a safe operation, a point which has not received due emphasis in the current discussions on the surgical management of peptic ulcer. The mortality rate in some 800 vagotomies was 0.5 per cent. The recurrence rate of ulcer after the operation is low—about 6 per cent. If only definitely proved recurrences are tabulated, the rate is 3 per cent. The incidence of severe postoperative digestive disturbances is also low, about 5 per cent; two-fifths of these are attributed to emotional factors, and three-fifths to organic digestive factors, such as the dumping syndrome, diarrhea or gastric retention. Gastric retention is a minimal problem, for pyloroplasty affords good drainage of the stomach after vagotomy.[27] In the overall evaluation of the late results of vagotomy and pyloroplasty, it has been noted that a very satisfactory result occurs in 89 per cent of the cases.[25]

In certain cases, however, the pathologic condition is such that pyloroplasty is not a suitable procedure. In some of these cases at the VA hospital, Billroth I gastric resection was done. The preference for vagotomy and pyloroplasty accounts for the highly selective nature of cases for Billroth I gastric resection. Data on the 20 cases in which this procedure was chosen are given in Table 1.

Billroth I gastric resection was chosen in these cases because of certain advantages:

1. The entire surgical procedure is performed in the supracolic compartment. The mesocolon is undisturbed, and the danger of inadvertent injury of the middle colic vessels is less and the possibility for a postoperative internal hernia into the lesser sac is avoided. There are fewer adhesions below the mesocolon, and thus the danger of a postoperative intestinal obstruction is less.

2. The danger of a blow-out of the duodenal stump, which is a dreaded and often fatal complication of the Billroth II gastric resection, is avoided.

3. The procedure can be performed more easily and more rapidly than a Billroth II gastric resection, for there are fewer technical steps.

4. The possibility of obstruction of the efferent limb of the gastrojejunal anastomosis due to kinking is obviated. The occurrence of a gastrojejunalcolic fistula is also obviated.

5. The normal continuity of the gastrointestinal tract is maintained. The presence of chyme in the duodenum produces maximal stimulation of secretin, the most powerful stimulus for the production of bile and pancreatic secretion. Duodenal exclusion as with a Billroth II gastric resection interferes with this mechanism. The maintenance of normal continuity also promotes thorough mixing of the food with the bile and pancreatic juice.

6. The gastric remnant empties more slowly after a Billroth I procedure. This may be related to the production of enterogastrone, which inhibits gastric motility. This hormone is produced in the duodenum in response to the presence of fat. Bohmansson expressed belief that this delayed gastric emptying is the most important factor in preventing the dumping syndrome.

7. The duodenum offers more resistance to recurrent ulceration than does the jejunum.[11] Furthermore the duodenum in response to the presence of chyme produces a factor that inhibits gastric acid production.[18] Both of these factors should play a role in preventing recurrent duodenal ulcer after a Billroth I gastric resection.

8. The maintenance of the continuity of the intestinal tract provides for utilization of the greatest absorptive area of small bowel, for no part of the small bowel is by-passed.

9. The maintenance of the normal gastrointestinal tract improves metabolic factors, as demonstrated by better fat and iron absorption, and better weight gain.[28]

The more important advantages of the Billroth I gastric resection are on the score of less severe and less frequent digestive and metabolic disturbances.

It has been the clinical impression of many surgeons, including Bohmansson, Perman,[17] Wallensten,[24] Clagett, Rauch,[21] Harkins, Moore, and others that this is so.

There were in addition several special advantages for the Billroth I gastric resection in the cases in which it was selected in the present series. For actively bleeding duodenal or gastric ulcers, the Billroth I procedure permits resection, and thereby gives good control of the bleeding ulcer. It has been noted that a good and safe gastroduodenal anastomosis can be made on a duodenum which, if a Billroth II had been done, would have presented great difficulty in closure of the duodenal stump, and probably would have required closure over an external catheter. For gastric ulcer the resection permits submitting the ulcer for immediate pathologic examination. If the frozen section shows malignant change, or if the permanent sections show malignant disease after the frozen section is interpreted as negative for cancer, it is much easier to proceed with radical operation after a Billroth I gastric resection.

It must be conceded that Billroth I gastric resection is not the only way of dealing with these cases. Vagotomy, pyloroplasty and ligation of the bleeding vessel in the ulcer bed has been used with favorable results,[26] and Movius, DaGradi and Weinberg[16] reported on the favorable results of using vagotomy, pyloroplasty and wedge resection of the stomach for gastric ulcer.

The Schoemaker modification of the Billroth I gastric resection was used exclusively in the present series. In 11 of the cases the operation was done in association with vagotomy. For duodenal ulcer, or for concomitant duodenal and gastric ulcer, a vagotomy, partial (60 per cent) gastrectomy and Billroth I anastomosis were done. For gastric ulcer alone a partial (60 per cent) gastrectomy and Billroth I anastomosis were done. In the two cases of recurrent ulcer after vagotomy a 75 per cent partial gastrectomy and Billroth I were done.

No technical difficulties were encountered with these various degrees of partial gastrectomy. With mobilization of the duodenum by means of the Kocher maneuver, and mobilization of the greater curvature of the stomach to include the short gastric arteries, a 75 per cent partial gastrectomy and gastroduodenal anastomosis can be done without tension. The addition of vagotomy when it is indicated adds to the ease of mobilizing the gastric remnant for anastomosis.

The gastroduodenal anastomosis has been performed with interrupted No. 50 cotton sutures, two rows posteriorly; but only one row anteriorly. If the cut ends in the stomach and duodenum are different in size, the smaller one can be enlarged with an incision along the anterior longitudinal axis. No difficulty of stomal obstruction or of leakage has occurred with this technique. Roentgen studies three months after operation showed complete emptying of the gastric remnant at three hours.

Morbidity with the Billroth I gastric resection was minimal. One patient had questionable thrombophlebitis and was treated with anticoagulants. Another patient had superficial wound separation down to the anterior fascia of the rectus muscle. The wound healed by secondary intention. The only complication directly attributed to the procedure was in a patient who had severe bleeding from the suture line of closure of the lesser curvature of the stomach on the fifth postoperative day. Operation was required to control the hemorrhage. A small incision was made and the bleeding vessel was secured with a transfixation ligature.

The one fatal case in the series was that of a patient who died on the eleventh postoperative day of pneumonitis and multiple abscesses of the lung. He had a carcinoma of the hypopharynx that had been previously treated with radiation, and he had great difficulty swallowing. The operation was done to control bleeding from a posterior duodenal ulcer which had eroded the gastroduodenal artery. The patient did well for seven days after operation. At that time he complained of pain in the right hemithorax and became febrile. His condition progressively deteriorated until death in spite of all treatment.

The early postoperative results were gratifying. The Billroth I gastric resection proved to be technically effective in dealing with the cases for which it was used in this series, especially in dealing with cases of bleeding duodenal or gastric ulcers, and of concomitant duodenal and gastric ulcers. The patients were studied radiographically and clinically three months after operation. The postoperative x-ray studies have shown complete emptying of the gastric remnant in three hours and no objective evidence of recurrent ulcer. None of the patients complained of recurrent ulcer pain. Complaints of digestive difficulties were minimal. Three patients noted a moderately decreased capacity for food. One had occasional loose stools. One had slight weakness after meals. The most severe digestive complaints, consisting of postprandial fullness, nausea and occasional vomiting, occurred in a 39-year-old woman who had had a previous duodenal-jejunal anastomosis to relieve efferent obstruction of a gastroenterostomy. The Billroth I gastric resection was done for a bleeding duodenal ulcer, and the duodenal-jejunal anastomosis was left intact. The patient was well satisfied in spite of the postoperative complaints, for the disabling ulcer pain was completely relieved. Postoperative x-ray studies showed complete emptying of the gastric remnant in

TABLE 2.—*Results of Billroth I gastric resection*

Case No.	Age and Sex	Disease	Indication	Operation	Complication	3-Month Followup		Weight Since Operation
						Ulcer Pain	Digestive Symptoms	
1.	60 M	Gastric ulcer	Suspicion of carcinoma	Gastrectomy 60% Billroth I	None	None	None	No change
2.	32 M	Duodenal ulcer	Pyloric obstruction	Vagotomy Gastrectomy 50% Billroth I	Bleeding from site of lesser curvature closure	None	None	
3.	61 M	Two gastric ulcers	Gastric ulcer	Gastrectomy 60% Billroth I	None	None	None	3 lb. gain
4.	38 F	Duodenal ulcer	Active bleeding	Vagotomy Gastrectomy 60% Billroth I	None	None	Moderate postprandial distress, nausea, occasional vomiting	
5.	57 M	Gastric ulcer	Gastric ulcer	Gastrectomy 60% Billroth I	None	None	None	13 lb. loss
6.	65 M	Duodenal and gastric ulcer	Pyloric obstruction	Vagotomy Gastrectomy 60% Billroth I	None	None	Mild decreased capacity for food	13 lb. gain
7.	59 M	Gastric ulcer	Active bleeding	Gastrectomy 60% Billroth I	None	None	Mild decreased capacity for food	10 lb. gain
8.	31 M	Gastric ulcer and duodenal scar	Gastric ulcer	Vagotomy Gastrectomy 60% Billroth I	None	None	None	22 lb. gain
9.	66 M	Gastric and duodenal ulcer	Suspicion of carcinoma	Vagotomy Gastrectomy 60% Billroth I	None	None	None	3 lb. gain
10.	75 M	Gastric ulcer	Pyloric obstruction	Gastrectomy 60% Billroth I	None	None	Moderate loss of strength	13 lb. loss
11.	43 M	Gastric ulcer	Gastric ulcer	Gastrectomy 60% Billroth I	None	None	None	No change
12.	55 M	Duodenal ulcer	Active bleeding	Vagotomy Gastrectomy 60% Billroth I	Death on 11th postoperative day from multiple abscesses of right lower lobe. Patient had great difficulty swallowing because of carcinoma of hypopharynx.			
13	47 M	Duodenal ulcer	Active bleeding	Vagotomy Gastrectomy 60% Billroth I	None	None	Mild weakness after meals	16 lb. loss
14.	52 M	Gastric ulcer and duodenal scar	Pyloric obstruction	Vagotomy Gastrectomy 60% Billroth I	None	None	Occasional diarrhea	9 lb. gain
15.	23 M	Duodenal ulcer	Active bleeding	Vagotomy Gastrectomy 60% Billroth I	None	None	Mild decreased capacity for food	No change
16.	23 M	Two duodenal ulcers	Active bleeding	Vagotomy Gastrectomy 60% Billroth I	None	None	None	No change
17.	42 M	Duodenal ulcer	Active bleeding	Vagotomy Gastrectomy 60% Billroth I	Superficial wound dehiscense	None	None	No change
18.	28 M	Duodenal ulcer	Duodenal ulcer after vagotomy & pyloroplasty	Gastrectomy 75% Billroth I	None	None	None	No change
19.	61 M	Gastric ulcer	Gastric ulcer	Gastrectomy 60% Billroth I	Thrombophlebitis			
20.	71 M	Jejunal ulcer	Jejunal ulcer after vagotomy gastroenterostomy	Gastrectomy 75% Billroth I	None			

three hours. All the rest of the patients were free of symptoms.

It is acknowledged that the period of observation of these patients after operation was too short to warrant definitive conclusions. The early results nevertheless were encouraging enough to merit continuing the study.

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